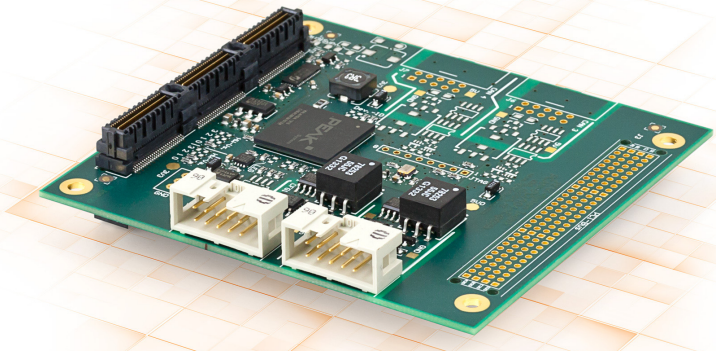
PCAN-PCI/104-Express

CAN Interface for PCI/104-Express

User Manual



Document version 2.3.0 (2014-10-07)

PEAK System

Products taken into account

Product Name	Model	Part Number
PCAN-PCI/104-Express Single Channel	One CAN channel	IPEH-003054
PCAN-PCI/104-Express Dual Channel	Two CAN channels	IPEH-003055
PCAN-PCI/104-Express Single Channel opto-decoupled	One CAN channel, galvanic isolation for CAN connection	IPEH-003056
PCAN-PCI/104-Express Dual Channel opto-decoupled	Two CAN channels, galvanic isolation for CAN connections	IPEH-003057

The cover picture shows the product PCAN-PCI/104-Express Dual Channel opto-decoupled. Other product models have an identical form factor but vary in equipment.

On request you can get the product versions with stack-through connectors for the PCI bus

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1 Introduction

The PCAN-PCI/104-Express card enables the connection of one or two CAN networks to a PCI/104-Express-System. Up to three cards can be stacked together. The CAN bus is connected using a 9-pin D-Sub plug on the slot bracket supplied. The opto-decoupled versions also guarantee galvanic isolation of up to 500 Volts between the PC and the CAN sides. Device drivers and programming interfaces exist for different operating systems, so programs can easily access a connected CAN bus.

Tip: At the end of this manual (Appendix C) you can find a Quick Reference with brief information about the installation and operation of the PCAN-PCI/104-Express card.

1.1 Properties at a Glance

- PCI/104-Express card, 1 Lane (x1)
- Form factor PC/104
- Up to 3 cards can be used in one system
- 1 or 2 High-speed CAN channels (ISO 11898-2)
- Bit rates from 5 kbit/s up to 1 Mbit/s
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- CAN bus connection via D-Sub, 9-pin (in accordance with CiA® 102)
- CAN controller FPGA implementation (SJA1000 compatible)
- NXP PCA82C251 CAN transceiver
- Galvanic isolation on the CAN connection up to 500 V (only opto-decoupled models), separate for each connector

- PCI-104 stack-through connector
- 5-Volts supply to the CAN connector can be connected through solder jumper, e.g. for external bus converter
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

Note: This manual describes the use of the PCAN-PCI/104-Express card with **Windows**. You can find device drivers for **Linux** and the corresponding application information on the provided DVD in the directory branch `Develop` and on our website under www.peak-system.com/linux.

1.2 System Requirements

- PC/104 stack with PCIe/104 connectivity to the host
- Operating system Windows 8, 7, Vista (32/64-bit) or Linux (32/64-bit)

1.3 Scope of Supply

- PCAN-PCI/104-Express card
- Slot bracket with D-Sub connectors for the CAN bus
- Device drivers for Windows 8, 7, Vista and Linux (32/64-bit)
- PCAN-View CAN monitor for Windows 8, 7, Vista (32/64-bit)
- PCAN-Basic programming interface consisting of an interface DLL, examples, and header files for all common programming languages
- Manual in PDF format

2 Installing the Software and the Card

This chapter covers the software setup for the PCAN-PCI/104-Express card under Windows and the installation of the card in the PC/104 stack (short: stack).

Note: Under Windows the PCAN-PCI/104-Express card is run as a PCI card.

Setup the driver before inserting the card into the stack.

Do the following to install the driver:

1. Make sure that you are logged in as user with administrator privileges (not needed for normal use of the card later on).
2. Insert the supplied DVD into the appropriate drive of the computer. Usually a navigation program appears a few moments later. If not, start the file `Intro.exe` from the root directory of the DVD.
3. On the page **English** > **Drivers** activate the entry **PCAN-PCI**.
4. Click on **Install now**. The setup program for the driver is executed.
5. Follow the instructions of the program.

Tip: If you don't want to install the CAN monitor PCAN-View for Windows onto the hard disk together with the driver, you have the option to start the program later directly from DVD without prior installation.

Do the following to insert the card into the stack:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the PCAN-PCI/104-Express card. Take precautions to avoid ESD when handling the card.

Note: PCI/104-Express cards must always be positioned next to the host.

Note: Cards with serial numbers up to 499 do not pass on the 12-Volt supply on the PCI**e**/104 connector (only 5 V and 3,3 V). On these cards, the connector for the PCI bus can be equipped which alternatively passes thru the 12-Volt supply.

1. Shutdown the system and disconnect it from the power supply.
2. Insert the card into the stack next to the host or to another PCI/104-Express card.

   A maximum of 3 PCI/104-Express cards per stack is possible, either all on top or all beneath the host.
3. Plug a cable from the slot bracket to a 10-pin socket for each CAN connection.
4. Reconnect the power supply of the system.

Do the following to complete the initialization:

1. Turn on the system and start Windows. Make sure that you are logged in as user with administrator privileges.

   Windows notifies that new hardware has been detected.
2. The drivers are found and installed by Windows.
3. Afterwards you can work as user with restricted rights again.

After the driver has been successfully set up, you can find the entry “PCAN-PCI” in the “CAN-Hardware” branch of the Windows Device Manager.

3 Connecting the CAN Bus

3.1 D-Sub connector

A High-speed CAN bus (ISO 11898-2) is connected to the 9-pin D-Sub connector. The pin assignment corresponds to the specification CiA® 102.

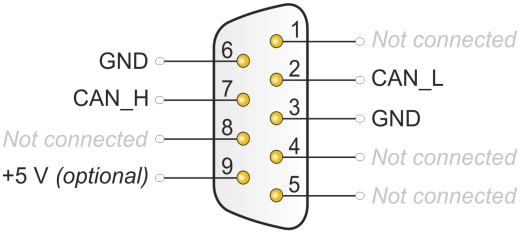

Figure 1: Pin assignment High-speed CAN

The pin assignment between the D-Sub port and the 10-pin connector on the PCAN-PCI/104-Express card is as follows:

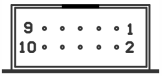

Figure 2: Numbering at the 10-pin connector

Pin	Assignment	Assignment D-Sub
1	not connected	1
2	GND	6
3	CAN_L	2
4	CAN_H	7
5	GND	3
6	not connected	8
7	not connected	4
8	+5 V (optional)	9
9	not connected	5
10	not connected	

Tip: You can connect a CAN bus with a different transmission standard via a bus converter. PEAK-System offers different bus converter modules (e.g. PCAN-TJA1054 for a Low-speed CAN bus according to ISO 11898-3).

3.1.1 Slot Bracket with D-Sub Connectors

Figure 3: Single channel slot bracket

Figure 4: Dual channel slot bracket

To connect a CAN bus to the PCAN-PCI/104-Express card, use the supplied slot brackets. After you have connected the cables from the slot bracket with the 10-pin sockets, you can connect the CAN busses with the D-Sub sockets.

3.2 Supplying External Devices via the CAN Connector

A 5-Volt supply can optionally be routed to pin 9 of a D-Sub connector by setting solder bridges on the PCAN-PCI/104-Express card (independently for each connector on the Dual Channel models). Thus devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector.

When using this option the 5-Volt supply is connected to the power supply of the computer and is not fused separately. The opto-decoupled models of the card contain an interconnected DC/DC converter. Therefore the current output is limited to 50 mA.

➡ Proceed as follows to activate the 5-Volt supply:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the PCAN-PCI/104-Express card. Take precautions to avoid ESD when handling the card.

Set the solder bridge(s) on the card according to the desired settings. During this procedure take especially care not to produce unwanted short circuits on the card.

Figure 5 shows the positions of the solder fields on cards with serial numbers up to 159. The table below contain the possible settings. Figure 6 refers to cards from serial number 200. Here, the solder bridges must be set on the bottom side of the card.

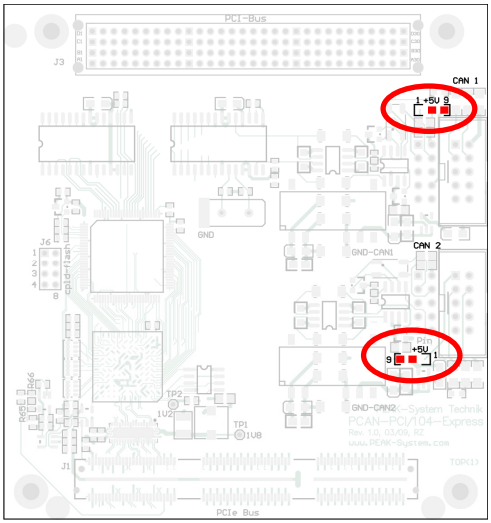

Figure 5: Positions of the soldering fields on the PCAN-PCI/104-Express card up to serial number 159,
upper position for CAN channel 1, lower position for CAN channel 2

5-Volt supply →	None	Pin 9
CAN channel 1	1 9	1 9
CAN channel 2	9 1	9 1

Note: The pin labels for the CAN connector are related to the 9-pin D-Sub connector being connected via a cable to a socket on the card.

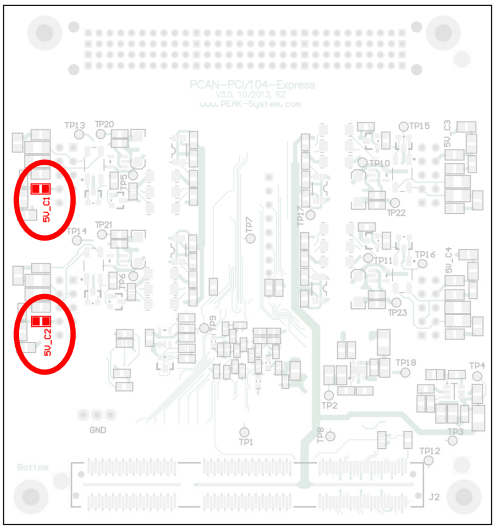

Figure 6: Positions of the soldering fields on the PCAN-PCI/104-Express card from serial number 200 (bottom view),
upper position for CAN channel 1, lower position for CAN channel 2

Attention! Risk of short circuit! If the option described in this section is activated, you may only connect or disconnect CAN cables or peripheral systems (e.g. bus converters) to or from the PCAN-PCI/104-Express card while the computer is deenergized.

3.3 Cabling

3.3.1 Termination

A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. Otherwise, there are interfering signal reflections and the transceivers of the connected CAN nodes (CAN interface, control device) will not work.

The PCAN-PCI/104-Express card does not have an internal termination. Use the adapter on a terminated CAN bus.

3.3.2 Example of a Connection

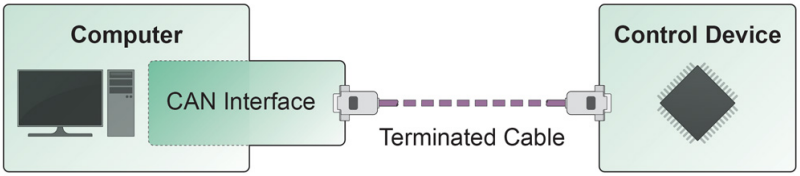

Figure 7: Simple CAN connection

In this example, the PCAN-PCI/104-Express card is connected with a control unit by a cable that is terminated at both ends.

3.3.3 Maximum Bus Length

High-Speed-CAN networks may have bit rates of up to 1 Mbit/s. The maximum bus length depends primarily on the bit rate.

The following table shows the maximum possible CAN bus length at different bit rates:

Bit rate	Bus length
1 Mbit/s	40 m
500 kbit/s	110 m
250 kbit/s	240 m
125 kbit/s	500 m
50 kbit/s	1.3 km
20 kbit/s	3.3 km
10 kbit/s	6.6 km
5 kbit/s	13.0 km

The listed values have been calculated on the basis of an idealized system and can differ from reality.

4 Using the Software

This chapter covers the provided software PCAN-View and the programming interface PCAN-Basic.

4.1 CAN Monitor PCAN-View for Windows

PCAN-View for Windows is a simple CAN monitor for viewing, transmitting, and logging CAN messages.

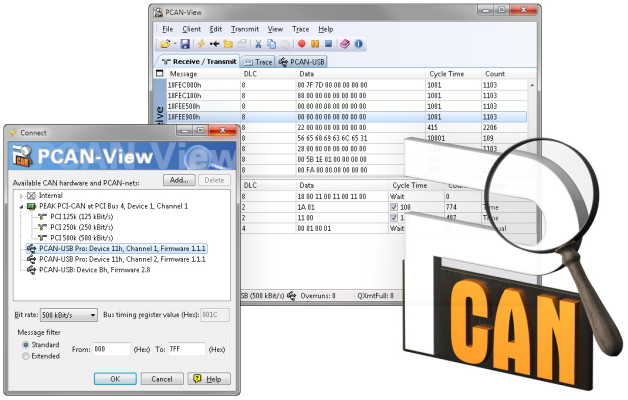

Figure 8: PCAN-View for Windows

Do the following to start and initialize PCAN-View:

1. If PCAN-View is already installed on the hard disk, open the Windows Start menu, go to **Programs** > **PCAN-Hardware**, and select the entry **PCAN-View**.

If you haven't installed PCAN-View together with the device driver, you can start the program directly from the supplied DVD. In the navigation program (`Intro.exe`) go to **English** > **Tools**, and under **PCAN-View for Windows** select the link **Start**.

The dialog box for selecting the CAN hardware and for setting the CAN parameters appears.

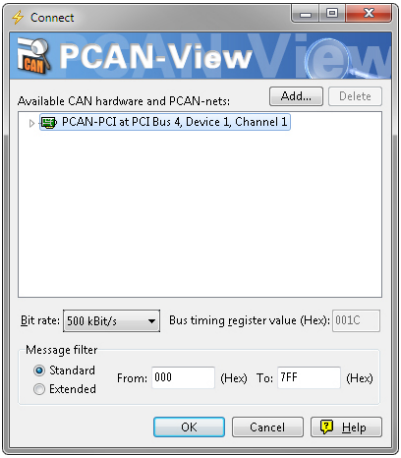

Figure 9: Selection of the CAN hardware and parameters

2. From the list **Available CAN hardware** select the CAN channel to be used.
3. Select the bit rate that is used by all nodes on the CAN bus from the list **Bit rate**.
4. Under **Filter settings** you can limit the range of CAN IDs to be received, either for standard frames (11-bit IDs) or for extended frames (29-bit IDs).
5. Finally confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 10).

4.1.1 Receive/Transmit Tab

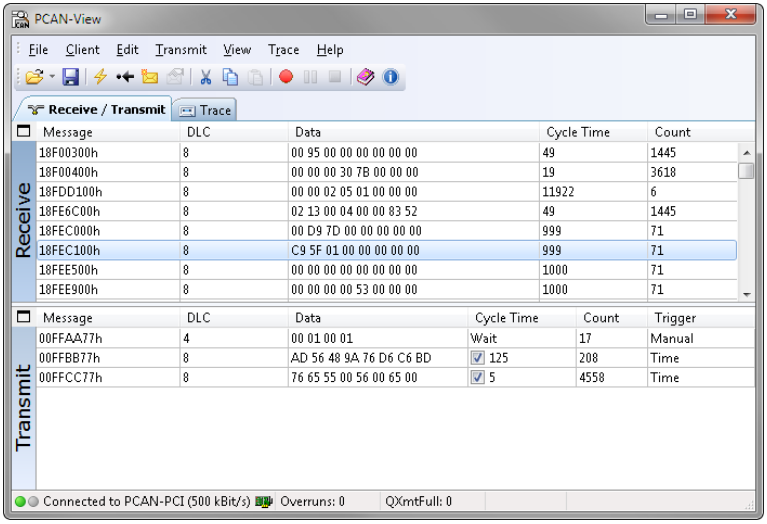

Figure 10: Receive/Transmit tab

The Receive/Transmit tab is the main element of PCAN-View. It contains two lists, one for received messages and one for the transmit messages. Representation of CAN data is in hexadecimal format.

Do the following to transmit a CAN message with PCAN-View:

1. Select the menu command **Transmit** > **New Message** (alternatively or Ins).

   The dialog box **New Transmit Message** is shown.

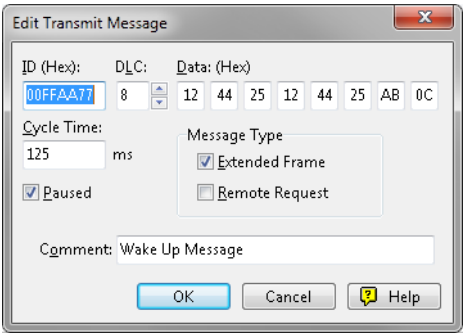

Figure 11: Dialog box New transmit message

2. Enter the ID and the data for the new CAN message.
3. The field **Cycle Time** indicates if the message shall be transmitted manually or periodically. If you want to transmit the message periodically, you must enter a value greater than 0. For a manual-only transmission enter 0.
4. Confirm the entries with **OK**.

   The created transmit message appears on the **Receive/Transmit** tab.
5. You trigger selected transmit messages manually with the menu command **Transmit** > **Send** (alternatively Space bar). The manual transmission for CAN messages being transmitted periodically is carried out additionally.

Tip: Using the menu command **File** > **Save** the current transmit messages can be saved to a list and loaded for reuse later on.

4.1.2 Trace Tab

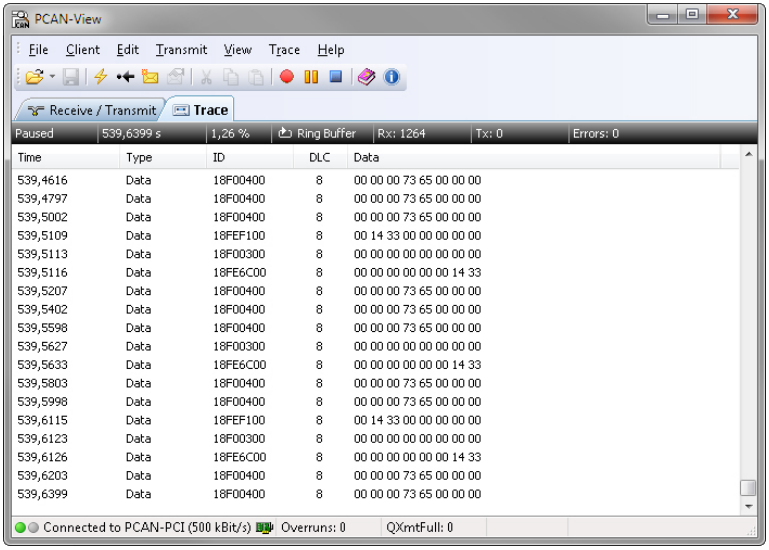

Figure 12: Trace tab

On the Trace tab the data tracer of PCAN-View is used for logging the communication on a CAN bus. During this process the CAN messages are cached in the working memory of the PC. Afterwards they can be saved to a file.

The tracer can be configured to run in linear or in ring buffer mode. In linear buffer mode the logging is stopped as soon as the buffer is filled completely. In ring buffer mode the oldest messages are overwritten by incoming ones.

4.1.3 Status Bar

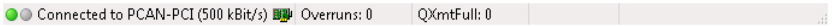

Figure 13: Display of the status bar

The status bar shows information about the current CAN connection, about error counters (Overruns, QXmtFull), and shows error messages.

You can find further information about the use of PCAN-View in the help which you can invoke in the program via the menu **Help** or the F1 key.

4.2 Linking Own Programs with PCAN-Basic

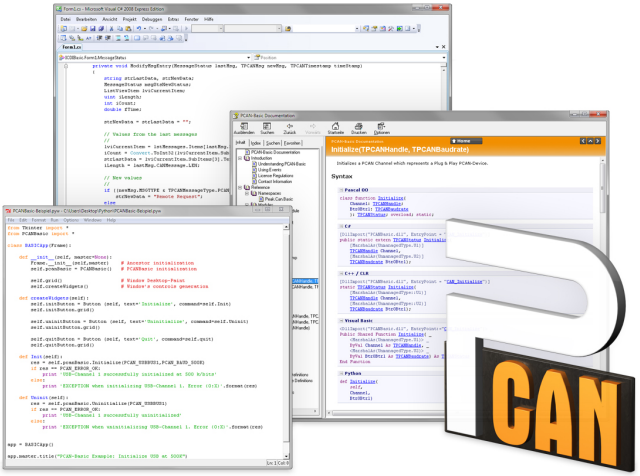

Figure 14: PCAN-Basic

On the provided DVD you can find files of the programming interface PCAN-Basic in the directory branch `Develop`. This API provides basic functions for linking own programs to CAN interfaces by PEAK-System and can be used for the following operating systems:

- Windows 8, 7, Vista (32/64-bit)

- Windows CE 6.x (x86/ARMv4)
- Linux (32/64-bit)

The API is designed for cross-platform use. Therefore software projects can easily ported between platforms with low efforts. PEAK-System has created examples for the following programming languages: C++, C#, C++/CLR, Visual Basic, Delphi, Python, and Java.

4.2.1 Features of PCAN-Basic

- Supports Windows 8, 7, Vista (32/64-bit), Windows CE 6.x, and Linux (32/64-bit) operating system
- Multiple PEAK-System applications and your own can be operated on a physical CAN channel at the same time
- Use of a single DLL for all supported hardware types
- Use of up to 8 channels for each hardware unit (depending on the PEAK CAN interface used)
- Simple switching between channels of a PEAK CAN interface
- Driver-internal buffer of 32,768 messages per CAN channel
- Precision of time stamps on received messages up to 1 µs (depending on the PEAK CAN interface used)
- Access to specific hardware parameters, such as listen-only mode
- Notification of the application through Windows events when a message is received
- Extended system for debugging operations
- Multilingual debugging output
- Output language depends on operating system
- Debugging information can be defined individually

An overview of the API functions is located in the header files. You can find detailed information about the PCAN-Basic API on the provided DVD in the text and help files (file name extensions `.txt` and `.chm`).

4.2.2 Principle Description of the API

The PCAN-Basic API is the interface between the user application and device driver. In Windows operating systems this is a DLL (Dynamic Link Library).

The sequence of accessing the CAN interface is divided into three phases:

1. Initialization
2. Interaction
3. Completion

Initialization

A CAN channel must be initialized before using it. This is done by the simple call of the function `CAN_Initialize`. Depending on the type of the CAN hardware, up to eight CAN channels can be opened at the same time. After a successful initialization the CAN channel is ready for communication with the CAN hardware and the CAN bus. No further configuration steps are required.

Interaction

For receiving and transmitting CAN messages the functions `CAN_Read` and `CAN_Write` are available. Additional settings can be made, e.g. setting up message filters to confine to specific CAN IDs or setting the CAN controller to listen-only mode.

When receiving CAN messages, events are used for an automatic notification of an application (client). This offers the following advantages:

- The application no longer needs to check for received messages periodically (no polling).
- The response time at reception is reduced.

Completion

To end the communication the function `CAN_Uninitialize` is called in order to release the reserved resources for the CAN channel, among others. In addition the CAN channel is marked as "Free" and is available to other applications.

4.2.3 Notes about the License

Device drivers, the interface DLL, and further files needed for linking are property of the PEAK-System Technik GmbH and may be used only in connection with a hardware component purchased from PEAK-System or one of its partners. If a CAN hardware component of third-party suppliers should be compatible to one of PEAK-System, then you are not allowed to use or to pass on the driver software of PEAK-System.

If a third-party supplier develops software based on the PCAN-Basic and problems occur during the use of this software, consult the software provider.

5 Technical Specifications

Connectors	
PC/104 stack	PCIe/104[1], PCI Express x1 (1 Lane) Stack-through PCI/104-Bus, equipped with contact strip on request
CAN	D-Sub (m), 9 pins Pin assignment according to specification CiA® 102

CAN	
Specification	ISO 11898-2, High-speed CAN 2.0A (standard format) and 2.0B (extended format)
Bit rates	5 kbit/s - 1Mbit/s
Controller	FPGA implementation (SJA1000 compatible)
Transceiver	NXP PCA82C251
Galvanic isolation	PCAN-PCI/104-Express: none PCAN-PCI/104-Express opto: up to 500 V separate for each CAN channel
Supplying external devices	PCAN-PCI/104-Express: D-Sub Pin 9; 5 V, max. 100 mA PCAN-PCI/104-Express opto: D-Sub Pin 9; 5 V, max. 50 mA Not assigned at delivery
Termination	none

Power supply			
Current consumption (max.)		at 3.3-V pin	at 5-V pin
	Single Channel:	250 mA	50 mA
	Dual Channel:	250 mA	75 mA
	Single Channel opto:	250 mA	120 mA
	Dual Channel opto:	250 mA	150 mA

[1] Cards with serial numbers up to 499 do not pass on the 12-Volt supply on the PCI**e**/104 connector (only 5 V and 3,3 V). On these cards, the connector for the PCI bus can be equipped which alternatively passes thru the 12-Volt supply.

Measures	
Size	90.2 x 95.9 mm (W x L) See also dimension drawing in Appendix B on page 28
Weight	Single Channel: 42 g Dual Channel: 47 g Single Channel opto: 44 g Dual Channel opto: 50 g

Environment	
Operating temperature	-40 - 85 °C (-40 - 185 °F)
Temperature for storage and transport	-40 - 125 °C (-40 - 257 °F)
Relative humidity	15 - 90 %, not condensing
EMC	EN 55024:2011-09 EN 55022:2011-12 EC directive 2004/108/EG

Appendix A CE Certificate

PCAN-PCI/104-Express IPEH-003054/55/56/57 – EC Declaration of Conformity
PEAK-System Technik GmbH

Notes on the CE Symbol CE

The following applies to the "PCAN-PCI/104-Express" product with the item number(s) IPEH-003054/55/56/57.

EC Directive This product fulfills the requirements of EU EMC Directive 2004/108/EG (Electromagnetic Compatibility) and is designed for the following fields of application as for the CE marking:

Electromagnetic Immunity
DIN EN 55024, publication date 2011-09
Information technology equipment – Immunity characteristics – Limits and methods of measurement (CISPR 24:2010);
German version EN 55024:2010

Electromagnetic Emission
DIN EN 55022, publication date 2011-12
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22:2008, modified);
German version EN 55022:2010

Declarations of Conformity In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities at the address below:

PEAK-System Technik GmbH
Mr. Wilhelm
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29
E-mail: info@peak-system.com

Signed this 22nd day of October 2013

Appendix B Dimension Drawing

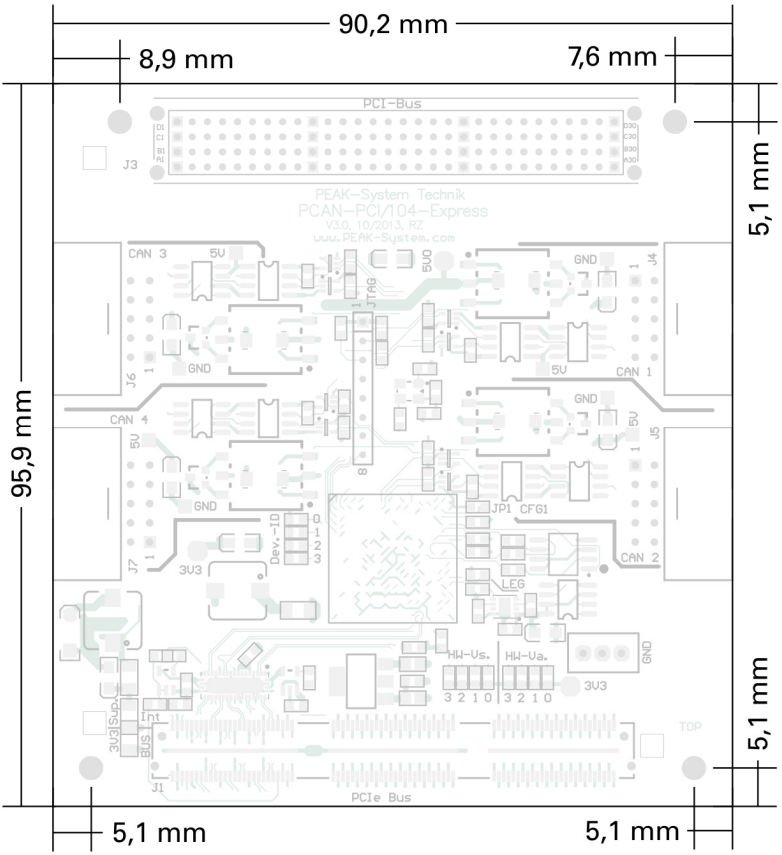

Figure 15: Dimension drawing PCAN-PCI/104-Express

Appendix C Quick Reference

Software/Hardware Installation under Windows

Before installing the PCAN-PCI/104-Express card in a PC/104 stack, setup the corresponding software package from the supplied DVD (with Administrator privileges). Afterwards insert the card into a PC/104 stack of the switched off computer. The card is recognized by Windows and the driver is initialized. After the installation process is finished successfully you can find the entry “PCAN-PCI” in the branch “CAN-Hardware” of the Windows Device Manager.

Getting Started under Windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the PCAN-PCI/104-Express card. For initialization of the card select the desired CAN channel and the CAN bit rate.

High-speed CAN connector (D-Sub, 9 pins)